REMARKS

The Office Action of September 21, 2004 has been carefully studied. Applicants acknowledge that the only issue concerns claim 28 which is a substantial duplicate of claim 21. Since claim 28 is now cancelled, the application is in condition for allowance.

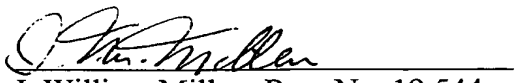
In any case, enclosed is the missing translated copy of Applicants' priority document which was submitted in order to overcome the Kerchville reference. It is noted, however, that this translation is not really needed inasmuch as the Office Action states that Kerchville is distinguished since the cross-linked acrylic resin of claim 12 is not disclosed therein. It is also seen that claim 12 is amended for the sake of clarity.

With respect to the Farnand reference, the Examiner is correct insofar as in the past acetic acid has been produced by the destructive distillation of hardwood, therefore, anything to the contrary set forth in Applicants' preceding remarks is hereby withdrawn. In any case, the Office Action states that Farnand is distinguished by the teaching in claim 24 of an emulsion produced in the treatment of a well bore drilled in an oil based mud.

In view of this amendment, it is believed that the application is in condition for allowance. Counsel regrets that a simple telephone call would not have been sufficient to respond to the Office Action since it was necessary, since it was prudent in Counsel's opinion to complete the submission of the translation of Applicant's priority document, and otherwise to respond to the Office Action.

The Commissioner is hereby authorized to charge any fees associated with this response or credit any overpayment to Deposit Account No. 13-3402.

Respectfully submitted,



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Date: December 13, 2004
IWM:pdr

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Done in Paris on OCTOBER 25, 2001

For the General Director of the National
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Confirmation of filing by fax

2 **NATURE OF THE APPLICATION Check one of the 4 boxes below**

Patent Application X

3 **TITLE OF THE INVENTION (200 characters or spaces maximum)**

ORGANIC DEMULSIFYING FORMULATION AND ITS USE IN THE TREATMENT OF DRAINS DRILLED IN OIL-BASED MUD

4 **DECLARATION OF PRIORITY OR REQUEST TO USE THE FILING DATE OF A PRIOR FRENCH APPLICATION**

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8	**SEARCH REPORT**	**Only for a patent application (including division and transformation)**	
	Immediate drawing-up X		
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TITLE OF THE INVENTION (200 characters or spaces maximum)

ORGANIC DEMULSIFYING FORMULATION AND ITS USE IN THE TREATMENT OF DRAINS DRILLED IN OIL-BASED MUD

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ORGANIC DEMULSIFYING FORMULATION AND ITS USE IN THE TREATMENT OF DRAINS DRILLED IN OIL-BASED MUD

Field of the Invention

The invention relates to the treatment of drains drilled in oil-based mud.

It relates more particularly to a demulsifying formulation that can be used in the treatment of drains that are drilled in oil-based mud that is preferably non-ecotoxic and that is optimally compatible with formation fluids, that comprises at least one component that is selected from among the non-ionic amphiphilic compositions that are obtained by reaction of at least one vegetable oil, optionally polymerized, on at least one amino alcohol, and alkyl esters (for example, C1 to C8) of fatty acids that are derived from natural, vegetable or animal oils; optionally at least one wetting agent; and optionally at least one solvent (or diluent); said demulsifying formulation being used in an organic base so as to limit as much as possible phenomena of in-situ emulsion formation and re-saturation in the aqueous phase of the well approaches.

Technological Background

A petroleum formation is damaged when a well is shown to be less productive than analyses of well tests predicted. The mechanisms of formation damage depend on the type of reactions produced between the well fluid, and the formation and rock fluids under the working conditions (pressure and temperature of the layer and the mud). The alteration of the productive formation that is close to the well is due to harmful interactions between the formation fluids and the foreign fluids that are introduced. If the

well fluids prove to be responsible for the damage, chemical treatment is then necessary to restore the characteristics of the reservoir. It should therefore make it possible to destroy the external cake and/or the internal cake and to clean the damaged zone at the well approaches. This treatment may or may not be associated with an acid-type matrix treatment.

As a general rule, the oil-based well fluids generate little filtrate, have good rheological properties and form a thin and permeable cake. By contrast, they contain charged chemical additives (surfactants) to emulsify the water in the form of droplets within the continuous oil-based phase and to make wettable in oil the solid particles that are used as weight-increasing or viscosity-promoting. These surfactants with a large excess concentration in the fluid to maintain the stability of the reverse emulsion can penetrate into the formation with the filtrate.

Three types of damage are particularly conceivable in the case of oil-based fluids:

- The formation of an emulsion within the reservoir, resulting from interactions between the filtrate of the oily mud (which contains primarily oils and surfactants) and the reservoir fluids (brine and oil). The emulsifying agents that are introduced in excess in the formulation can come into contact with the formation. A significant shearing in the constriction of pores in the presence of the emulsifying agent, however, can result in the formation of a very stable and very viscous emulsion producing a reduction of the effective mobility of the hydrocarbons that are present;
- An alteration of the initial wettability of the reservoir rock. The emulsifying agent-type products generally transform the initially water-wettable rock into a

state of intermediate wettability and even oil-wettability, which can bring about a modification of the permeability relative to the oil and therefore reduce the mobility of the oil; and

- The deposition of fine mobile particles in the pores (reduction of absolute permeability).

The chemical composition of the filtration cake must be carefully considered when designing treatment fluids. The cake consists primarily of emulsified water droplets that act as colloidal particles and combine with solid particles in suspension in the fluid to form a cake. The stability of the emulsion, the type and nature of the solids influence both the losses of fluid and the cake's filtration properties. The choice of treatment product must take into account the parameters that are necessary for washing the cake and leaching the formation.

The envisaged treatment relates to:

- Dissolving or dispersing the weight-increasing agents that are present in the cake, and
- The attack of the additives that are contained in the filtrate.

The treatment should therefore be adapted to the type of mud that is used. The primary parameters to be considered are:

- The type of damage and its extent;
- The characteristics of the reservoir (porosity and permeability);
- The type of formation (nature of the rocks and acid solubility);
- Possible contaminants (water, mud – water-based mud and oil-based mud, cements, bacteria);

- The compatibility of the treatment fluid with the contaminants;
- The bottom pressure and the temperature;
- The treatment time; and
- The physical limitations of the well equipment.

The improvement in the design of a drilling fluid that is aimed at reducing damage can be completely ruined by using an unsuitable procedure and/or cleaning product. The solutions for treating oil-based mud cakes that are currently proposed are in aqueous form and generate considerable additional damage and can even block the well. Numerous examples of treating drains with the aid of surfactants that are used in the aqueous phase can be found in the literature (Patents US-A-4 681 165, 4 595 511, 4 681 164 and 5 110 487). The use of oil-based surfactants to break emulsions has been presented (Patents US-A-5 614 101, 5 256 305 and 4 416 754), but the object is not an application to petroleum production.

Summary of the Invention

This invention has as its object a demulsifying formulation that is used in an organic base (preferably in a non-polluting organic base that may be the oil of the mud itself), whereby said demulsifying formulation is capable of breaking a water-in-oil emulsion. The invention also has as its object the use of demulsifying formulation in an organic base in treating drilled drains in oil-based mud. The simplification of the treatment solution makes it possible to limit the effects of aqueous phase re-saturation at the well approaches and the formation of in-situ emulsions.

Detailed Description of the Invention

The demulsifying formulations in an organic base of the invention are characterized in that they comprise at least one component (referred to as "demulsifying agent" or "emulsion breaker" in the description below), optionally associated with a wetting agent and at least one solvent (or diluent), the whole being in a mixture in an organic base, comprising at least one non-ionic amphiphilic compound that is obtained by reaction of at least one optionally polymerized vegetable oil on at least one amino alcohol and/or at least one mixture of alkyl esters (for example, C1 to C8) of fatty acids that are derived from natural, vegetable or animal oils.

More particularly in the formulations of the invention, said demulsifying agent is present in a proportion of 0.5% to 100% by weight of pure active material; said wetting agent is present in a proportion of 0 to 50% by weight of pure active material; and said solvent (or diluent) is present in a proportion of 0 to 99.5% by weight; whereby the whole has a pure active material concentration of 0.5 to 100 g, preferably 0.01 g to 10 g per 100 g of said organic base.

The demulsifying agent (or "emulsion breaker") can consist of, on the one hand, at least one non-ionic amphiphilic composition that is obtained by reaction of at least one optionally polymerized vegetable oil on at least one amino alcohol. Such compositions have been described in French Patent FR-B-2 768 732 in the name of the same applicant.

In the preparation of such compositions, any vegetable oil can be suitable. Preferably, highly unsaturated oils, such as linseed oil, safflower oil, grapeseed oil, china wood oil, sunflower seed oil and mixtures thereof, are used. Linseed oil is preferred.

These vegetable oils are used as is or in polymerized form. Polymerized vegetable oils (commonly referred to as "stand oils") are obtained by heat treating the highly unsaturated vegetable oils that are cited above, under conditions in which there is no oxidation. Linseed oil (preferably refined) is generally used, but it is possible to use safflower oil, grapeseed oil, china wood oil, sunflower seed oil or mixtures thereof. After polymerization, the polymerized vegetable oils can have a viscosity at 20°C encompassed between 5 and 60 Pa.s. By way of example, heat treatment of a refined linseed oil at a temperature of 290-300°C produces a product with a viscosity of 10 Pa.s at 25°C within 6 to 12 hours.

The amino alcohols that are used to prepare the amphiphilic compositions that can form part of the composition of the formulations of the invention are generally amines or polyamines comprising one or more alcohol functions and optionally one or more ether functions.

For example, the amino alcohols can correspond to the following formulas:

$HO\text{-}C_mH_{2m}\text{-}NH_2$

$HO\text{-}C_mH_{2m}\text{-}NH\text{-}C_kH_{(2k+1)}$

$(HO\text{-}C_mH_{2m}\text{-})_2\text{-}NH$

$(HO\text{-}C_mH_{2m}\text{-})_p\ CH_{(3-p)}\text{-}NH_2$

with $m = 2$ to 6; $k = 1$ to 6; $p = 2$ or 3.

In particular, it is possible to cite:

monoethanolamine: $OH\text{-}(CH_2)_2\text{-}NH_2$,

monopropanolamine: $OH\text{-}(CH_2)_3\text{-}NH_2$,

monoisopropanolamine: $CH_3\text{-}CH(OH)\text{-}CH_2\text{-}NH_2$,

2-amino-1-butanol: CH_3-CH_2-$CH(NH_2)CH_2$-OH,

1-amino-2-butanol: CH_3-CH_2-CH(OH)-CH_2-NH_2,

N-methyl-ethanolamine: CH_3-NH-$(CH_2)_2$-OH,

N-butyl-ethanolamine: CH_3-$(CH_2)_3$-NH-$(CH_2)_2$-OH,

pentanolamine, hexanolamine, cyclohexanolamine, polyalkanolamines or else polyalkoxyglycolamines, with formula:

OH-$(CH_2$-CH_2-O-$)_n$-CH_2-CH_2-NH_2; (n between 1 and 30);

and amino polyols such as:

diethanolamine: (OH-CH_2-CH_2-$)_2$ NH;

diisopropanolamine: $(CH_3$-CH(OH)-$CH_2)_2$-NH, or

trihydroxymethylaminomethane: $((HO)H_2C$-$)_3$C-NH_2.

The synthesis of the compounds of the invention can be carried out by reaction of excess amino alcohol, preferably diethanolamine, on a vegetable oil, as is or polymerized, preferably polymerized linseed oil. Preferably, the reaction is carried out in the absence of a solvent and generally at a temperature of more than about 100°C, preferably encompassed between 100 and 200°C. If the viscosity of the reaction medium is too high, however, the reaction can be carried out in the presence of a solvent.

In contrast, the demulsifying agent (or "emulsion breaker") can consist of at least a mixture of alkyl esters (for example, C1 to C8) of fatty acids that are derived from natural, vegetable, or animal oils. In this case, any oil may also be suitable, but preference will be given to rapeseed oil. The demulsifying agent can, of course, consist of varying proportions of (a) at least one non-ionic amphiphilic composition that is obtained by reaction of at least one optionally polymerized vegetable oil on at least one

amino alcohol, and (b) at least one mixture of alkyl esters of fatty acids derived from a natural oil, for example of vegetable origin.

When it is present in the organic–based formulations of the invention, the wetting agent can be selected more particularly from among anionic surfactants, such as sodium dialkyl sulfosuccinates, for example sodium dioctyl sulfosuccinate.

The solvent (or diluent) that is optionally present in the formulations of the invention can be any organic base. More particularly, it can be selected from among petroleum fractions (such as kerosenes), alcohols and hydro-alcoholic mixtures. It can also be selected from among alkyl esters of long-chain carboxylic acids, such as 2-ethylhexyl esters of a carboxylic acid fraction with 8 to 10 carbon atoms, which will hereinafter be referred to as 2-ethylhexylC8C10. It can also be selected from among vegetable derivatives, such as alkyl ester compositions (for example, C1 to C8) of fatty acids that are derived from vegetable oils, for example methyl esters of rapeseed oil.

In the demulsifying formulations of the invention, the alkyl ester compositions (for example, C1 to C8) of fatty acids that are derived from vegetable oils can thus act as a demulsifying component itself or as a solvent (or diluent).

The proportion of solvent (or diluent) in the formulations of the invention is preferably between 20 and 40% by weight.

The base in which the composition that is defined above is used is generally a mineral oil or an oil of vegetable origin, preferably a non-polluting oil. As examples of oils of vegetable origin, it is possible to cite mixtures of alkyl esters (for example, C1 to C8) of vegetable oils, such as mixtures of methyl esters of rapeseed oil.

The organic base that is used can be an oil that is identical to that of the mud. In this case, it is possible to use, for example, a mineral oil, such as HDF 2000® oil or EDC 95® oil (sold by the Total Solvent Company), or else a vegetable oil, such as BDMF® oil (a mixture of methyl esters of rapeseed oil that is sold by the TotalFina Oléochimie Company).

In a variant, the organic base as defined above can itself act as a solvent (or diluent) with the components (demulsifier and/or wetting agent) of the formulations of the invention.

The invention also relates to the use of demulsifying formulations as described above for the treatment of drains that are drilled in oil-based mud.

In this application, the treatment formulations according to the invention are selected to correlate with the mud formulation so as to be compatible with the emulsifying systems and wetting agents that are generally used to disperse solids in the mud. The demulsifying formulations according to the invention meet selection criteria that can be checked by implementing the following determinations:

- Characterization of the cake destructuring action: in a crystallizer and in a static filtration cell by the technique of "Differential Scanning Calorimetry" (DSC) and cryomicroscopy;
- Compatibility of formation fluids (oil and brine), treatment fluids (demulsifying formulation in an oil base) and drilling fluids (filtrate from oil-based drilling mud): study of emulsion formation in situ.

The capability of a demulsifying formulation to be used according to the

invention is primarily verified by the DSC technique. This technique is described in detail in "Utilisation de la DSC pour la caractérisation de la stabilité des emulsions eau dans pétrole [Use of DSC for the Characterization of the Stability of Water-in-oil Emulsions]" (C. Dalmazzone, H. Séris – Revue de l'Institut Français du Pétrole [Journal of the French Petroleum Institute], Vol. 53, No. 4, 1998). The technique is carried out on cake samples before and after treatment to evaluate emulsion breakage within the cake.

The DSC thermal technique is generally used to determine the composition of water-in-oil emulsions because it can distinguish free water from emulsified water (free water crystallizes at much higher temperatures than water droplets in an emulsion). This technique is based on the solidification and melting properties of droplets and of the medium in which they are dispersed. The data obtained relate to:

- The type of emulsion: simple (water-in-oil or oil-in-water) or multiple (water-in-oil-in-water or oil-in-water-in-oil);
- The quantity of liquid and its state: bound or dispersed or free;
- The compositions of the free and dispersed forms;
- The mean diameter of the droplets and their evolution based on time due to coalescence or Ostwald ripening;
- Material transfers between droplets due to their compositional difference.

The conditions to be satisfied for the demulsifying system are:

- Compatibility of the oil-based mud filtrate, reservoir fluids and treatment fluid. The proportion of each phase varies to be able to determine the formation of emulsions in the form of a ternary diagram. The emulsion formation is characterized by "bottle test"-type tests;

- Destructuring of cakes that are obtained using API tests by emulsion-breaking. Cake destructuring is evaluated by analyzing DSC curves and by cryomicroscopy.

Examples

The following examples illustrate the invention without limiting its scope. In these examples, four types of formulations have been tested:

Example 1: Methyl esters of pure rapeseed oil.

Example 2: Non-ionic amphiphilic composition that is obtained by reacting polymerized linseed oil on diethanolamine, with 50% by weight in methyl esters of rapeseed oil.

Example 3: Non-ionic amphiphilic composition that is obtained by reacting polymerized linseed oil on diethanolamine with 50% by weight in a mixture of equal weights of methyl esters of rapeseed oil and 2-ethylhexylC8C10, in solution at 1 g/100 ml in 2-ethylhexylC8C10. This formulation thus contains 50% by weight of pure demulsifier and, in total, 50% by weight of solvents. It was used in solution in 2-ethylhexylC8C10 at a concentration of 10 g/l.

Example 4: The formulation has the following composition:

- Demulsifier: 5% by weight of non-ionic amphiphilic composition that is obtained by reacting polymerized linseed oil on diethanolamine,
- Wetting agent: 25% by weight of Aerosol OTS® (70% by weight of sodium dioctyl sulfosuccinate in a petroleum fraction) and 20% by weight of Celanol DOS® (65% by weight of sodium dioctyl sulfosuccinate in a hydroalcoholic mixture);
- Diluent: 50% by weight of Ketrul 210 (deodorized kerosene fraction);
- The whole being in solution at 1 g/100 ml in a mineral oil HDF2000 (oil of the mud).

This formulation therefore contains 5% by weight of pure demulsifier, 30.5% by weight of pure wetting agent, and, in total, 64.5% by weight of solvent. It is used in solution in the oil at a concentration of 10 g/l.

Three types of tests are used to evaluate the oil-based mud cake destructuring effectiveness of the treatment: a crystallizer destructuring test, a static cell filtration test, and a test for compatibility between the reservoir fluids, the formation fluids, and the treatment fluid.

Crystallizer Cake Destructuring Test

The kinetic aspects of cake destructuring were studied on a commercial oil-based mud formulation.

Principle:

The oil-based mud is filtered through filter paper in a static filtration cell according to the API procedure at a temperature of 80°C and under a pressure difference of 35 bar for one hour. Pieces of cake that are obtained are placed in crystallizers in contact with 20 ml of treatment solution for varying periods at ambient temperature. Emulsion-breaking within the cake is evaluated using the DSC technique.

Pieces of filter paper supporting the cake are cut up with a scalpel. The mass of the samples is about 10 mg, weighed precisely. The sample is placed in an aluminum capsule using tweezers. Particular care is taken during the handling of the sample (cutting with the filter paper, introduction into the capsule) to avoid damaging the cake mechanically.

The cell is then introduced into the furnace of the DSC device next to an empty reference cell. The cell then undergoes a cooling-heating cycle from 20°C to -120°C. Heat flow Q is recorded (in W/g) as a function of temperature T (in °C). It was calibrated initially with a cell that contains brine at the same $CaCl_2$ concentration as the mud. The presence of water in the sample is detected by the brine crystallization peaks.

Qualitatively, the temperature corresponding to the peaks makes it possible to evaluate the state of the water in the sample, whereby free water crystallizes at higher temperatures than emulsified water. In contrast, the shape of the peak makes it possible to determine the polydispersed nature (irregular peak or exhibiting a shoulder) or the monodispersed nature (uniform and sharp peak) of the emulsion within the cake, which provides information on its stability.

From a quantitative viewpoint, the position of the peaks makes it possible to evaluate the fineness of the emulsion (the droplets have a much smaller diameter, the lower the crystallization temperature). Further, the size of the peaks makes it possible to access the mass of water that is present in the sample.

TABLE 1: Mud System that is Used

	BAROID 80-20® Formulation
Base Oil	HDF 2000® Mineral Oil
Brine	Water, with 24% by weight of $CaCl_2$

Static Filtration Test

Mud formulation A (BAROID) is filtered according to the API procedure (API 13 standard) at a temperature of 80°C and under a pressure difference of 35 bar. After filtering 300 ml of mud for one hour, the cell is depressurized, emptied of mud, rinsed with 200 ml of treatment solution, then filled with 300 ml of treatment solution. The cake inside the cell is left in contact with the treatment solution for a variable period at 10 bar and at 80°C ("soaking time") before beginning a new filtration.

Compatibility Test

From the viewpoint of avoiding additional damage to the formation at the wall, it is necessary to control the formation or otherwise of in-situ emulsions by selecting a treatment fluid that is compatible with the reservoir fluids (brine and oil) and the mud filtrate.

In this example, brine (NaCl, 20 g/l) was brought into contact with an organic phase that consists of reservoir oil, mud filtrate and demulsifier.

The filtrate is reconstituted from base oil and mud surfactants. The following are brought into contact, in equal volumes: a mixture that consists of 80 ml of filtrate – 20 ml of emulsion (3 ml of NaCl brine, 20 g/l in 17 ml of reservoir oil) and 100 ml of treatment product. It is stirred manually (1 minute), and the emulsion is poured into a decanting flask.

The results that are obtained with each of the tested formulations are described below.

Example 1:

The crystallizer destructuring test is carried out with Formulation 1. Emulsion-breaking is total after 24 hours of contact time, which is shown by the appearance of a free water peak at about -40°C (cf. Figure 1 for 24 hours and Figure 2 for one week).

Example 2:

Crystallizer tests

From a qualitative standpoint, at ambient temperature, even at short contact times (24 hours), a clear change in the quality of the emulsion within the cake is observed. In the case of formulation 2, the initial emulsified water peak (-80°C) disappeared. Two joint peaks are observed at -69°C and -57°C. This increase in the temperature indicates a larger droplet size, and there is coalescence of the droplets within the cake. The emulsion appears more clearly polydispersed (presence of two droplet sizes (cf. Figure 3). After one week of contact time , the cake is considerably destructured (cf. Figure 4).

Example 3:

Like the formulation of Example 2, the formulation of this example makes it possible to obtain very rapid emulsion-breaking within the cake, observed using the crystallizer test (24 hours and one week): the emulsified water peak was actually displaced to -40°C, indicating the presence of very large droplets that can coalesce to form free water (cf. Figure 5 and Figure 6).

Example 4:

Crystallizer Tests:

A sample of treated cake is analyzed by the DSC technique as above. Emulsion-breaking within the cake is confirmed by the cooling-heating cycle that is obtained by DSC. For a contact time of 24 hours, a bulge is observed in the emulsified water peak: the emulsion becomes polydispersed (cf. Figure 7). For a contact time of one week, different peaks are observed on the crystallization curve: emulsified water in the form of very fine droplets is demonstrated by the peak at -80°C, while a bulge at about -60°C indicates the presence of fine droplets in the course of coalescence. The two small pointed peaks respectively reveal the presence of large droplets of free water released by the breaking of the emulsion (cf. Figure 8).

Static Filtration Tests:

In Figure 9, volume V is plotted in ml as a function of the square root of time in minutes (R_1) for different contact times before filtration (1 hour, 2 hours and 4 hours).

Comparison Example 5

The same type of test was conducted using a treatment product containing 6% by weight of the commercial product DM1® (provided by the BAROID Company) in solution in 64% by weight of base oil HDF 2000® and 30% by weight of an aromatic solvent, PARAGON®. The results that are shown in Figure 9 by the drainage curve as a function of time show a lower filtration slope than for the formulations of the invention.

Figure 10 shows the characterization in DSC of the cake that is treated by static filtration after a contact period of 2 hours: the destructuring of the cake is revealed by the coalescence of droplets within the emulsion (displacement of the crystallization peak to higher temperatures).

Compatibility Test:

The mud formulation and the treatment solution are brought into contact at equal volumes according to the operating procedure that is cited above. Immediate breaking of the emulsion that is formed is observed.

CLAIMS

1. Organic demulsifying formulation, characterized in that it comprises:

- at least one component that is selected from among non-ionic amphiphilic compositions that are obtained by reaction of at least one optionally polymerized vegetable oil on at least one amino alcohol, and alkyl esters of fatty acids that are derived from natural, vegetable, or animal oils;
- optionally at least one wetting agent;
- and optionally at least one solvent;
- whereby the whole is in a mixture in an organic base.

2. Formulation according to claim 1, wherein

- said demulsifying agent is present in a proportion of 0.5 to 100% by weight of pure surfactant; and
- said wetting agent is present in a proportion of 0 to 50% by weight of pure surfactant;
- said solvent is present in a proportion of 0 to 99.5% by weight;
- whereby the whole has a concentration of pure active materials of 0.5 to 100 g per 100 g of said organic base.

3. Formulation according to claim 1, wherein said demulsifying agent comprises at least one non-ionic amphiphilic composition that is obtained by reacting polymerized linseed oil with diethanolamine.

4. Formulation according to claims 1 to 3, wherein said demulsifying agent comprises at least a mixture of methyl esters of rapeseed oil.

5. Formulation according to claims 1 to 4, wherein said wetting agent is selected from among the anionic surfactants.

6. Formulation according to claim 5, wherein said wetting agent is a sodium dialkyl sulfosuccinate.

7. Formulation according to one of claims 1 to 6, wherein said solvent is selected from among petroleum fractions, alcohols, and hydro-alcoholic mixtures, from among alkyl esters of long-chain carboxylic acids and from among compositions of alkyl esters of fatty acids derived from vegetable oils.

8. Formulation according to claim 7, wherein said solvent is a mixture of methyl esters of rapeseed oil.

9. Formulation according to one of claims 1 to 8, wherein said organic base is a mineral oil or an oil of vegetable origin.

10. Formulation according to claim 9, wherein said organic base is non-polluting.

11. Formulation according to claim 9 or 10, wherein said oil of vegetable origin is a mixture of methyl esters of rapeseed oil.

12. Formulation according to one of claims 1 to 11, wherein, while the formulation is used to treat drains that are drilled in oil-based mud, the organic base of said formulation is an oil that is identical to that of the mud.

13. Use of a demulsifying formulation in an organic base according to one of claims 1 to 12 in the treatment of a drain that is drilled in oil-based mud.

FIG. 1

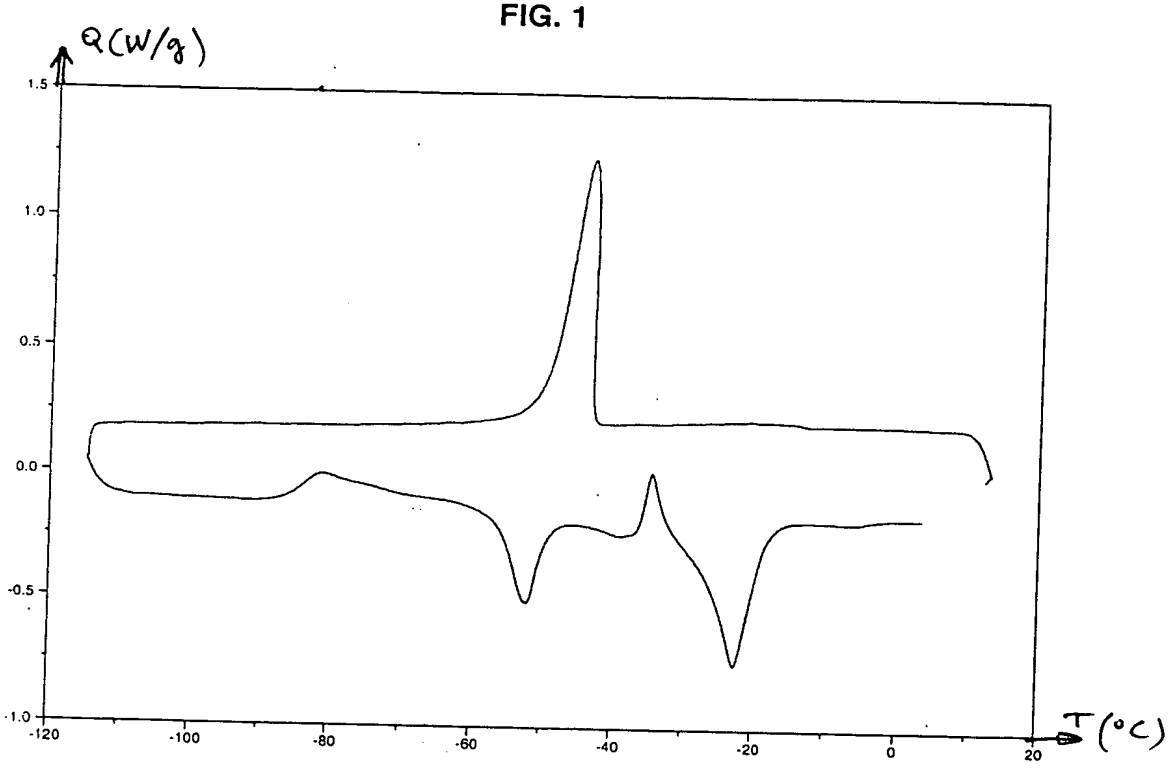


FIG. 2

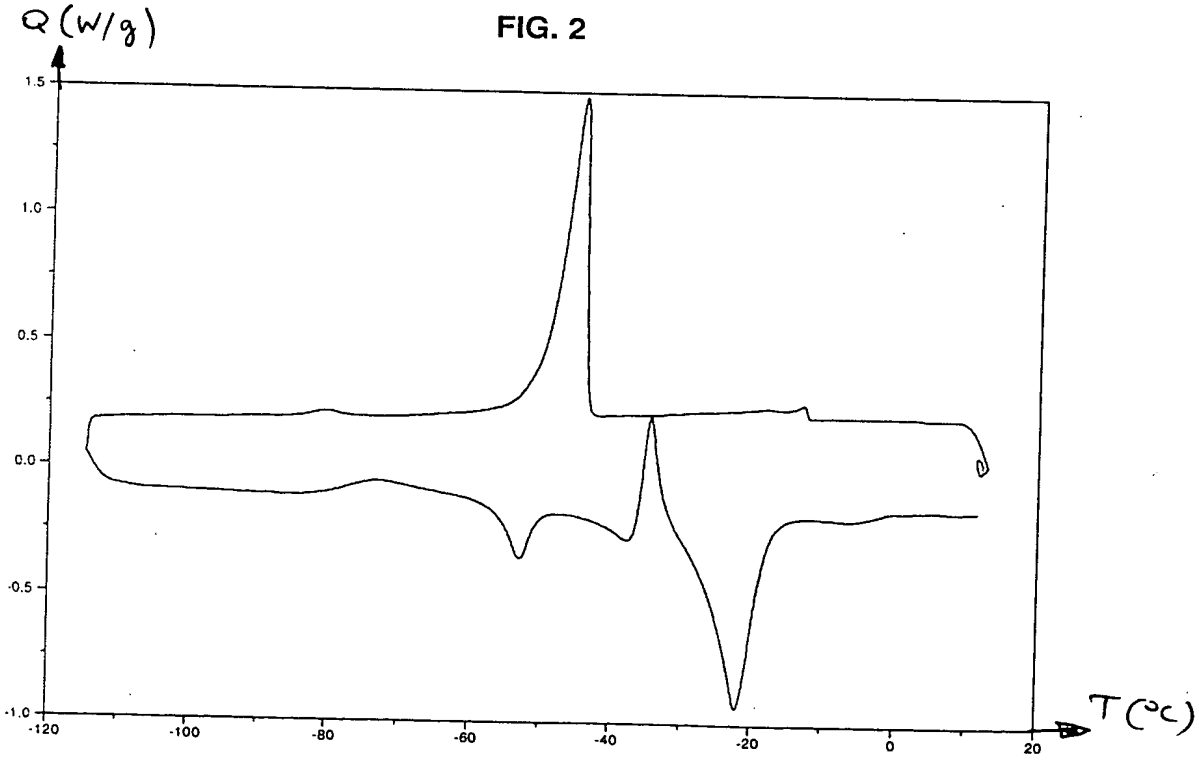


FIG. 3

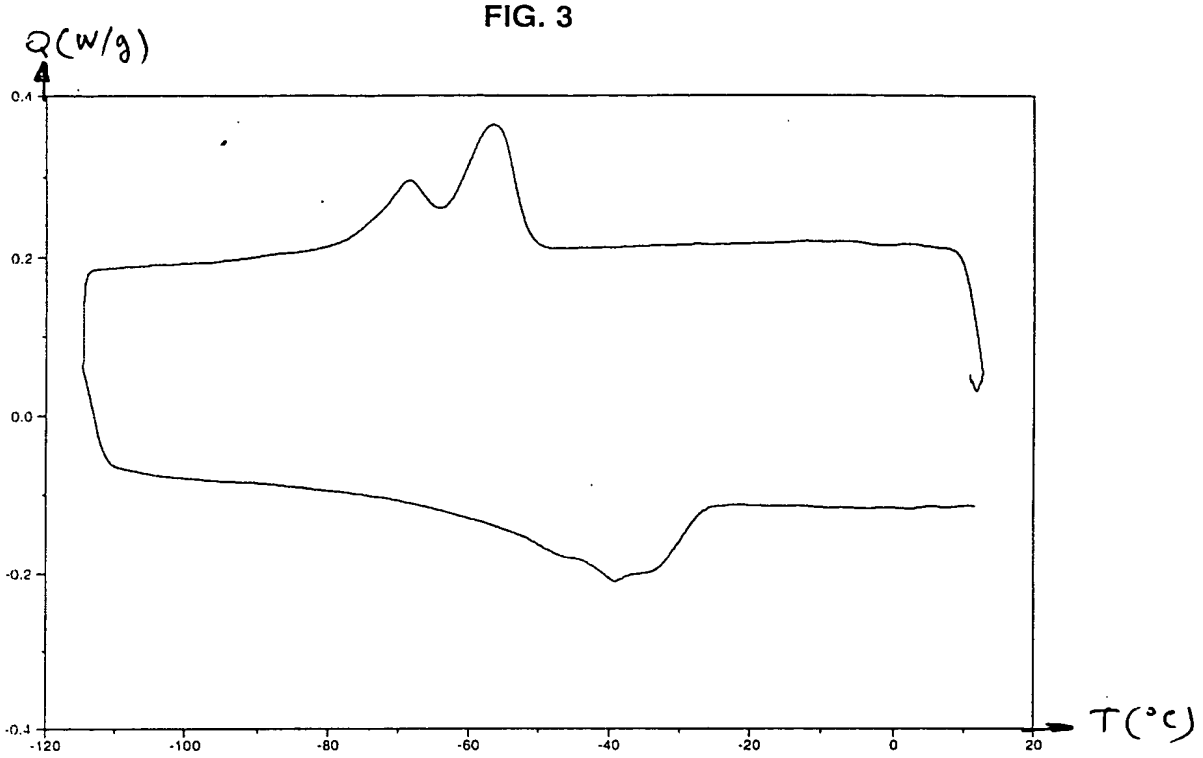

Q(w/g)
0.4
0.2
0.0
-0.2
-0.4
-120
-100
-80
-60
-40
-20
0
20
T(°C)

FIG. 4

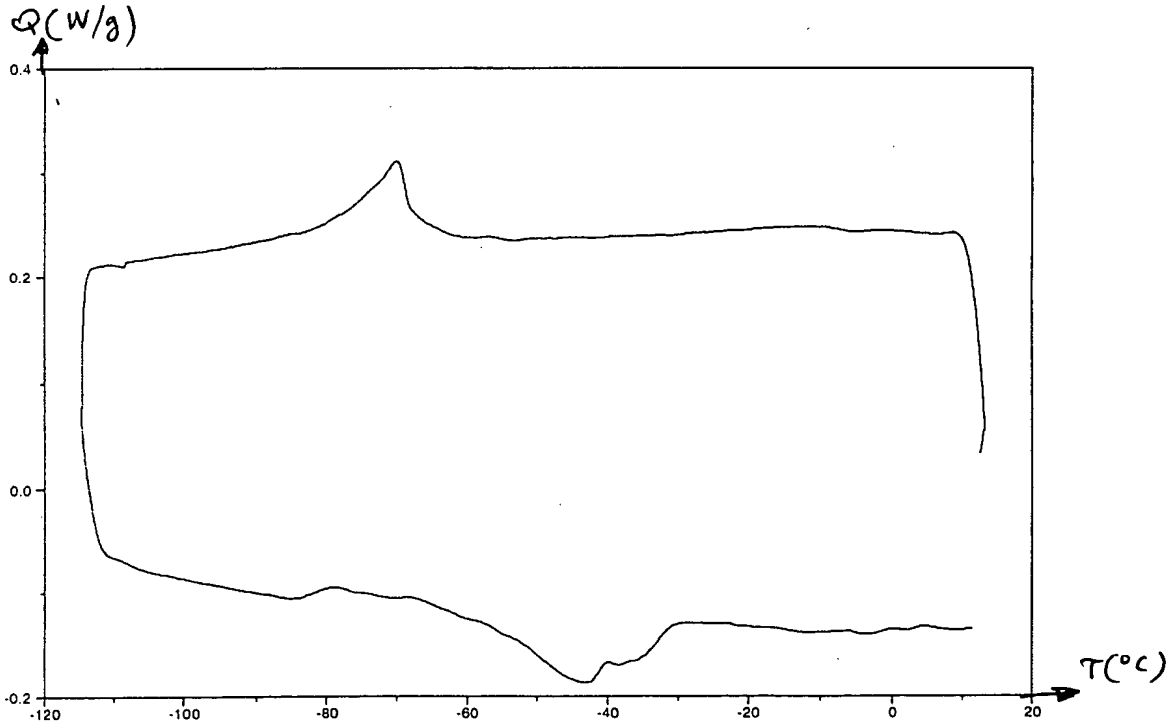

Q(w/g)
0.4
0.2
0.0
-0.2
-120
-100
-80
-60
-40
-20
0
20
T(°C)

FIG.5

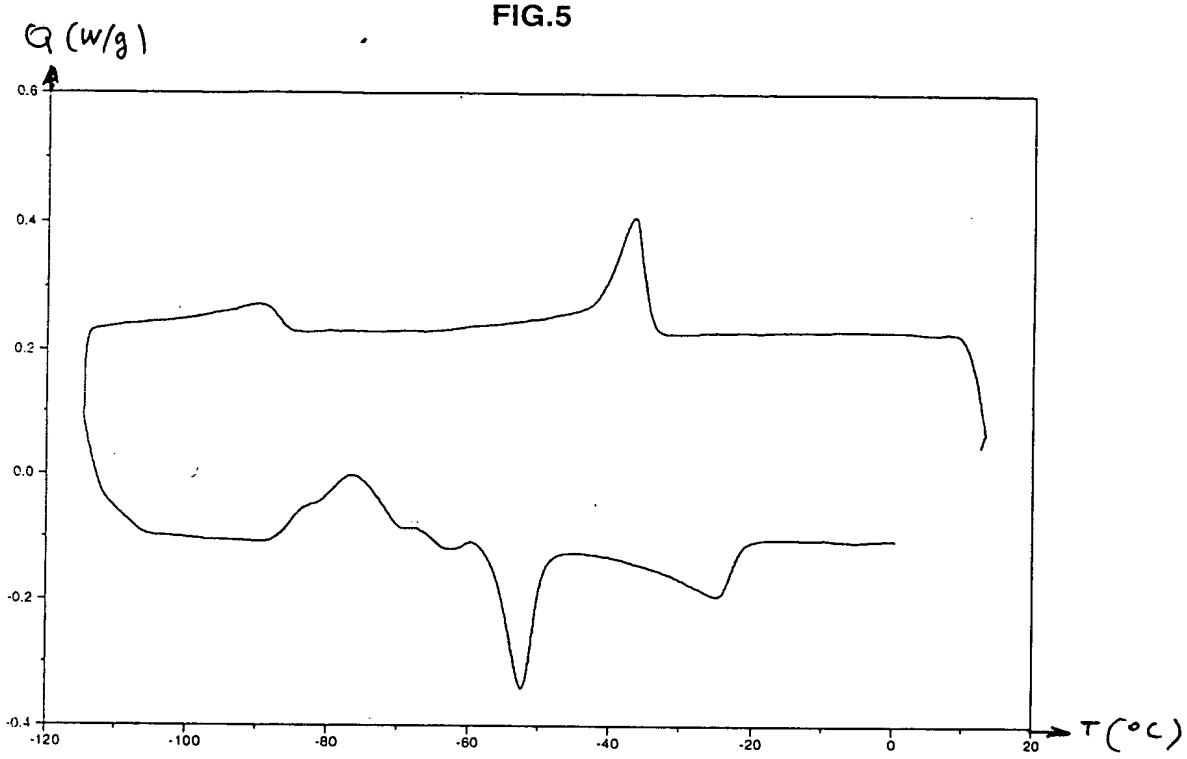

Q (w/g)
0.6
0.4
0.2
0.0
-0.2
-0.4
-120
-100
-80
-60
-40
-20
0
20
T (°C)

FIG. 6

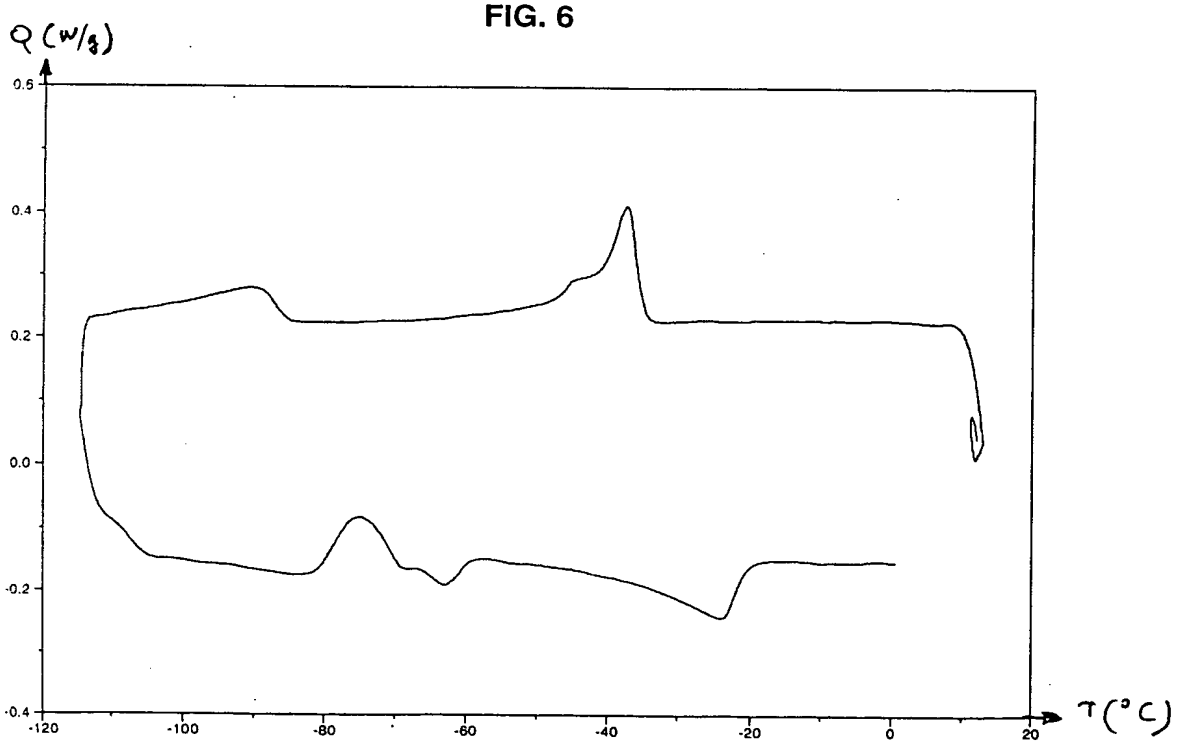

Q (w/g)
0.6
0.4
0.2
0.0
-0.2
-0.4
-120
-100
-80
-60
-40
-20
0
20
T (°C)

FIG. 7

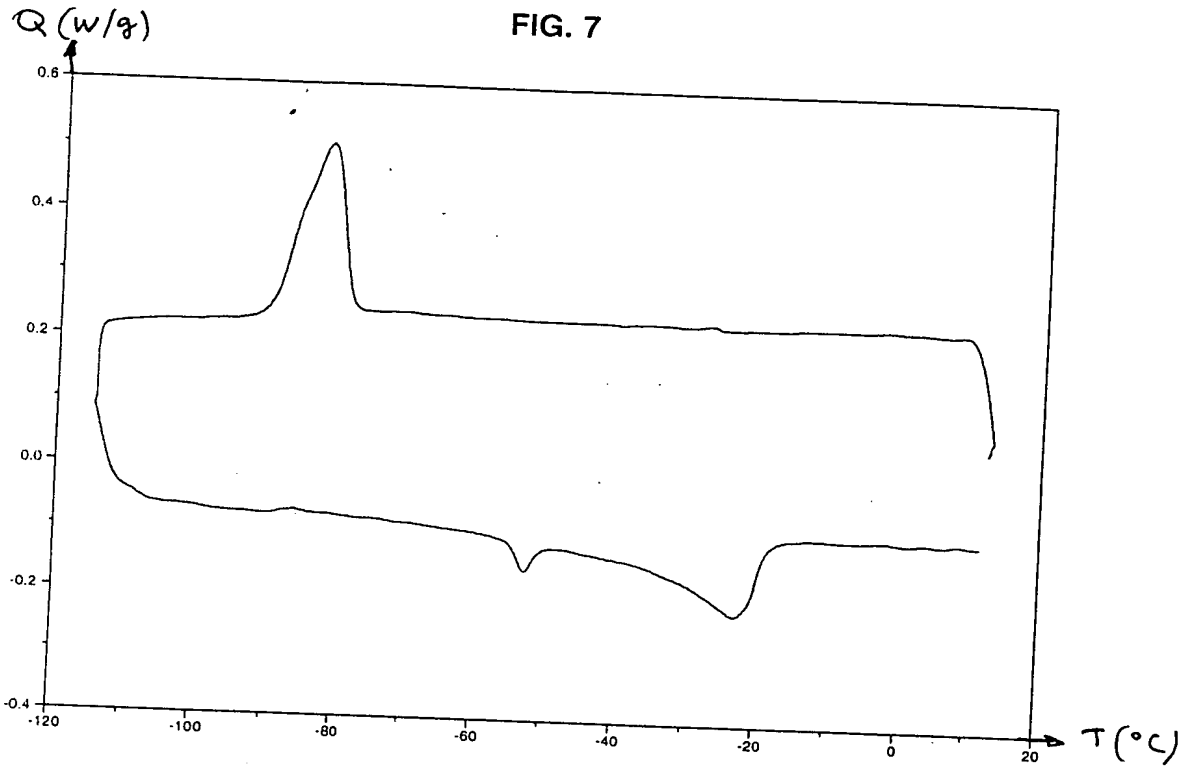

Q (w/g)
0.6
0.4
0.2
0.0
-0.2
-0.4
-120
-100
-80
-60
-40
-20
0
20
T (°C)

FIG. 8

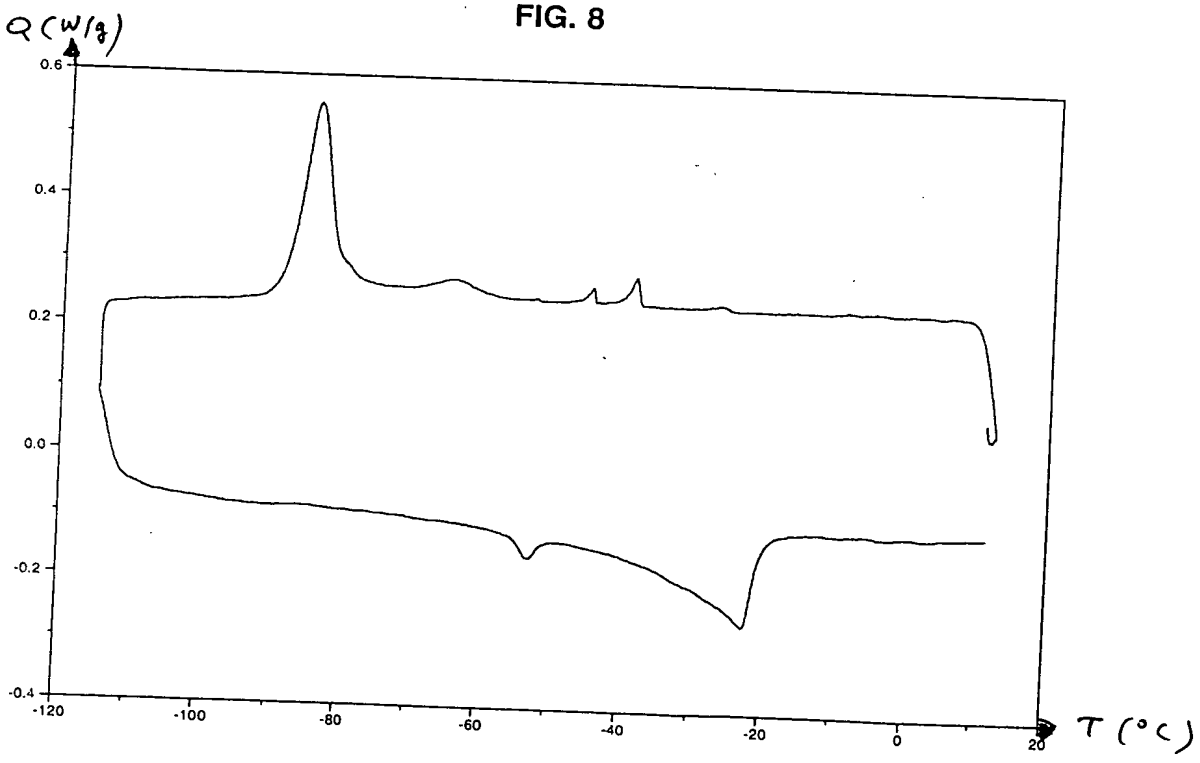

Q (w/g)
0.6
0.4
0.2
0.0
-0.2
-0.4
-120
-100
-80
-60
-40
-20
0
20
T (°C)

FIG. 9

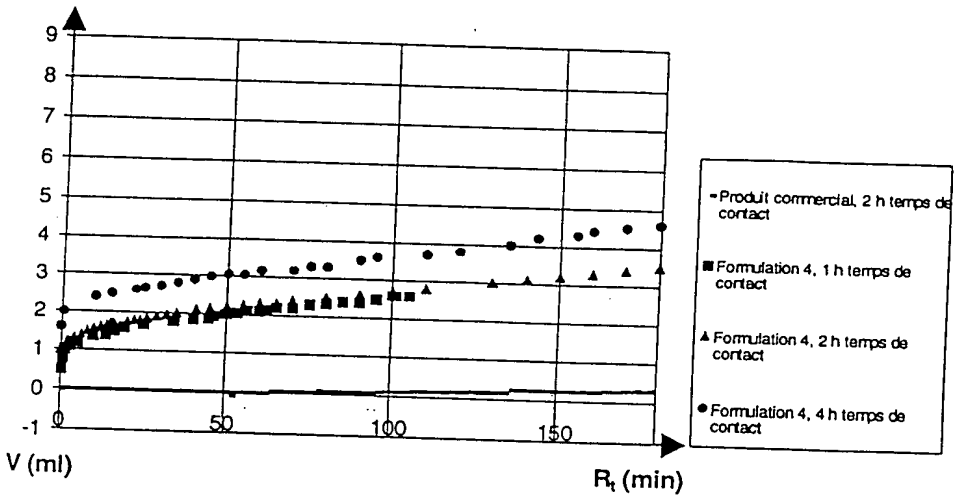
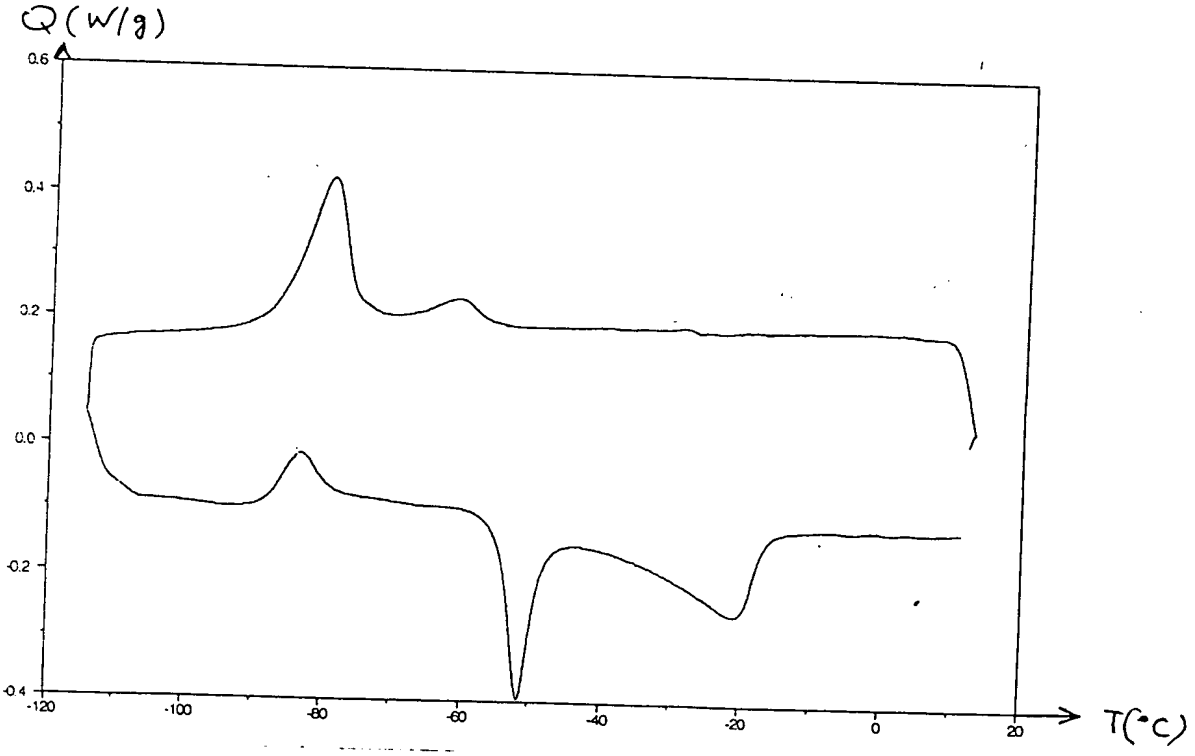


FIG. 10



[Key to Fig. 9:]

- ▪ Produit commercial, 2 h temps de contact = Commercial product, 2-hour contact period
- ■ Formulation 4, 1 h temps de contact = Formulation 4, 1-hour contact period
- ▲ Formulation 4, 2 h temps de contact = Formulation 4, 2-hour contact period
- ● Formulation 4, 4 h temps de contact = Formulation 4, 4-hour contact period